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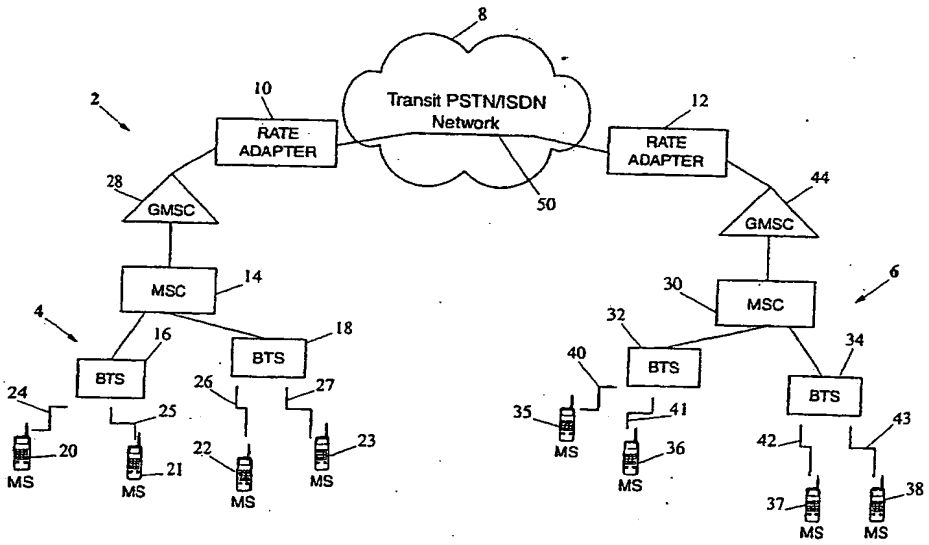
(54) Title: DATA RATE ADAPTATION BETWEEN MOBILE OR FIXED STATIONS THROUGH FIXED TRANSIT NETWORK



(57) Abstract: The present invention discloses a method and system for the inter-working of networks, particularly to the inter-working of communication or information, such as voice streams, through telecommunication networks. Most particularly, the present invention relates to enabling voice streams to be inter-worked between PLMN or fixed networks and PSTN/ISDN transit networks. The present invention discloses a system and method of enabling information to pass between a first network based on a first technology and a second network based on a second technology, in which rate adaptation is imposed upon the information prior to passing from the first to the second network.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

DATA RATE ADAPTATION BETWEEN MOBILE OR FIXED STATIONS THROUGH FIXED TRANSIT NETWORK

FIELD OF INVENTION

This invention relates to a method and system of communication between a first mobile/fixed station in a first mobile/fixed network and a second mobile/fixed station in a second mobile/fixed network. The invention particularly relates to a method and system for enabling communications to take place over a fixed telecommunications transit network from the first mobile/fixed network to the second mobile/fixed network.

In one form, the present invention relates to the inter-working of networks, particularly to the inter-working of information, such as voice streams, through telecommunication networks. Most particularly, the present invention relates to enabling voice streams to be inter-worked between PLMN or fixed networks and PSTN/ISDN transit networks.

BACKGROUND OF INVENTION

Agreements that allow operators to connect their equipment to one another's networks are well established. Agreements exist in relation to traffic capacity, signalling and dealings between international carriers such as those that allow international roaming.

In the past, such agreements were established between operators having the same type of technology, but today more increasingly there is a need for this sort of agreement to be established between operators of different technologies. Thus, interworking becomes a necessity to satisfy consumer demand.

However, interworking brings with it a number of other problems. For example, and as illustrated in the communication system 1 of Figure 1, mobile/fixed networks, shown by reference numerals 4a and 4b, which may include third generation Public Land Mobile Networks (PLMNs), such as the Universal Mobile Telecommunications Service (UMTS) and enhanced second generation PLMNs are capable of operating with compressed voice streams in their core networks.

Communications that are transmitted and received over network 4a,4b are performed typically at a different bit rate to communications that are transmitted and received over a fixed or switched telecommunications transit network 8 such

as the PSTN or ISDN. Over a network 4a,4b the bit rate of data transmissions is typically 8 or 16 kbit/s and the transmitted user data is often in a compressed format. Bit rate transmissions over the PSTN or ISDN networks 8 are conducted synchronously at 64 kbit/s in a Pulse Code Modulation (PCM) coded format. For example, voice data transmitted over the PSTN/ISDN network 8 is converted into a PCM code and transmitted at 64 kbit/s on a Time Division Multiplexed (TDM) basis.

Transcoders 5 are used to convert the bit rate in the up link and down link when a transmission respectively crosses from a mobile/fixed network 4a,4b to a PSTN or ISDN transit network 8 and vice versa. The transcoders 5 convert the compressed digital format of a mobile/fixed transmission at 8 or 16 kbit/s to an uncompressed digital format carried over the PSTN/ISDN 8 typically at a rate of 64 kbit/s. Where the call is from one mobile/fixed station 1a in a mobile/fixed network 4a to another mobile/fixed station 1b in a different mobile/fixed network 4b, the user data must be transcoded again by another transcoder 5 from the non-compressed digital format at 64 kbit/s into a compressed digital format at 8 or 16 kbit/s to be carried over the mobile/fixed network 4b to the second mobile/fixed station 1b.

If a call originating in a network 4a,4b traverses a PSTN/ISDN network 8, in other words, the voice stream passes from a network 4a to a PSTN/ISDN network 8, to a terminating network 4a, the voice stream is transcoded from its compressed format to a synchronous PCM coded format and then again transcoded back to its compressed format.

The quality of the voice transmission degrades each time the user data passes through a transcoder and undergoes a transcoding process from one bit rate to another bit rate due to the required manipulation of the coded voice data by the transcoder 5. Furthermore the use of transcoders 5 takes up valuable floor space at equipment installations and necessitates an increased board density in the equipment used.

An object of the present invention is to alleviate at least one disadvantage of the prior art.

SUMMARY OF INVENTION

The present invention provides a method of enabling information to pass between a first network based on a first technology and a second network based on a second technology, by imposing rate adaptation upon the information prior to passing from the first to the second network.

Preferably, the information is further passed from the second network to a third network based on the first technology, and rate adaptation is applied to the information passing from the second to the third network.

The present invention also provides a communication system having a first network based on a first technology, a second network based on a second technology, and interface means applying rate adaptation to information transferred from the first network to the second network.

Preferably, the system includes a further third network based on the first technology, and interface means applying rate adaptation to the information transferred from the second to the third network.

The second network may include a plurality of telecommunication networks.

Preferably, the information is a compressed voice stream.

According to one aspect of the invention there is provided a method of communicating between a mobile/fixed station in a first mobile/fixed telecommunications network and a mobile/fixed station in a second mobile/fixed telecommunications network whereby communication takes place over a fixed telecommunications transit network separating said first mobile/fixed and second mobile/fixed telecommunication networks, said method including the steps of: transmitting user data in a compressed digital format in said first mobile/fixed telecommunications network at a first mobile/fixed transmission rate; transmitting user data in said compressed digital format in said second mobile/fixed telecommunications network at a second mobile/fixed transmission rate; transmitting said user data in said compressed digital format in said fixed telecommunications transit network at a fixed transit network transmission rate, wherein said fixed transit network transmission rate is greater than said first mobile/fixed and second mobile/fixed transmission rates; and adapting the transmission rate of said user data at respective interfaces between said fixed telecommunications transit network and said first mobile/fixed and second

mobile/fixed telecommunications networks by inserting additional stuff data into respective frame structures containing said user data or extracting said additional stuff data from said respective frame structures.

The user data may be contained in a first mobile/fixed frame structure when transmitted across said first mobile/fixed network, in a second mobile/fixed frame structure when transmitted across said second mobile/fixed network and in a fixed transit network frame structure when transmitted across said fixed transit network.

The step of adapting may include inserting stuff bits into said fixed transit network frame structure when said user data is transmitted across an interface from either said first mobile/fixed or said second mobile/fixed network into said fixed transit network. The step of adapting may include removing stuff bits from said fixed transit network frame structure when said user data is transmitted across an interface from said fixed network to either of said first mobile/fixed or second mobile/fixed networks.

The step of adapting may include flag stuffing or flag extracting such that bits are either inserted into or removed from said respective frame structures containing said user data.

According to another aspect of the invention there is provided a system of communicating between a mobile/fixed station in a first mobile/fixed telecommunications network and a mobile/fixed station in a second mobile/fixed telecommunications network, said system including: said first mobile/fixed telecommunications network in which user data is transmitted in a compressed digital format at a first mobile/fixed transmission rate; said second mobile/fixed telecommunications network in which said user data is transmitted in said compressed digital format at a second mobile/fixed transmission rate; a fixed telecommunications transit network separating said first mobile/fixed and second mobile/fixed telecommunications networks, whereby said user data is transmitted across said fixed transit network in said compressed digital format at a fixed transit network transmission rate, said fixed transit network transmission rate being greater than said first mobile/fixed and second mobile/fixed transmission rates; and rate adapter means located at respective interfaces between said fixed

telecommunications transit network and said first mobile/fixed and second mobile/fixed networks for adapting the transmission rate of said user data to the transmission rate of the network subsequently carrying said user data as said user data traverses each said interface wherein additional stuff data is either inserted into or extracted from respective frame structures containing said user data.

The user data may be contained in a first mobile/fixed frame structure when transmitted across said first mobile/fixed network, in a second mobile/fixed frame structure when transmitted across said second mobile/fixed network and in a fixed transit network frame structure when transmitted across said fixed transit network.

The rate adapter means may include a first rate adapter unit interfacing said first mobile/fixed network with said fixed transit network and a second rate adapter means interfacing said second mobile/fixed network with said fixed transit network. The first rate adapter unit may insert stuff bits into said fixed transit network frame structure when said user data is transmitted from said first mobile/fixed network to said fixed transit network so as to adapt the user data to the fixed transit network transmission rate. The first rate adapter unit may extract stuff bits from said fixed transit network frame structure when said user data is transmitted from said fixed transit network to said first mobile/fixed network so as to adapt the user data to the first mobile/fixed transmission rate.

The second rate adapter unit may insert stuff bits into said fixed transit network frame structure when said user data is transmitted from said second mobile/fixed network to said fixed transit network so as to adapt the user data to the fixed transit network transmission rate. The second rate adapter unit may extract stuff bits from said fixed transit network frame structure when said user data is transmitted from said fixed transit network to said second mobile/fixed network so as to adapt the user data to the second mobile/fixed transmission rate.

The first mobile/fixed transmission rate and the second mobile/fixed transmission rate may be the same, such as full-rate, or different, such as half-rate and full-rate. As an alternative to using stuff bits, stuff flags may be used

such that bits are inserted into or extracted from respective frame structures containing said user data.

Preferably, the rate adaptation is performed by a bit stuffing technique.

In essence, the present invention realises that prior art networks transcode compressed voice streams when traversing an ISDN/PSTN transit network interconnecting two PLMN/fixed networks, and that this introduces speech quality degradation at each occurrence of the transcoding. In the present invention, it is proposed that the compressed voice stream is instead 'rate adapted' to enable it to be carried from one network to another network. Utilising rate adaptation instead of transcoding between different networks avoids the degradation associated with transcoding. Another advantage of the present invention is that the transcoding is deferred to another point, preferably more distal of the mobile/fixed station, in the network.

Thus, for example, the compressed voice coding of a PLMN network (which nominally has a bit rate of 8 - 16 kbit/s) is rate adapted (such as at 64 kbit/s) to enable it to be carried (in a 64 kbit/s timeslot) through the PSTN/ISDN.

One example of rate adaptation is "bit stuffing" and it would be understood that other similar techniques, doing away with the need to manipulate the actual voice coding, and hence affecting the voice quality are also applicable to the present invention and hence fall within the ambit of the present invention. Information as to what coding is applied to the voice is either implicitly known or indicated by signalling associated with the call through the PSTN/ISDN.

A further aspect of the present invention is that in prior art 2nd generation networks, for example, transcoders are located in the RAN (Radio Access Network), not at the edge or interface of a core network. This aspect of invention stems from the idea of replacing conventional transcoders (currently located at the junction of networks of differing technologies) with rate adaptation devices. In effect, the transcoder or transcoding action is deferred to a more central stage in the overall network. This has been found to reduce the number of transcoding steps required (because the transcoding steps are not performed at the junction of networks) for information, such as voice streams, to flow through a number of networks having

differing technologies, and thus avoids the consequent quality degradation inherent with each transcoding step.

In a preferred form, rate adaptation is not so much changing technology formats as changing transmission speed. Transcoding of the prior art changes formats, whereas in one preferred form, the present invention changes speed of transmission.

Throughout this specification, by 'information' we mean data, voice, video and / or any other form of information electronically transmissible. A preferred form of the invention relates to the transmission of voice streams.

Also by "fixed" station or network we mean that wireline connections are used to access the relevant network.

The invention will hereinafter be described in a preferred embodiment relating to mobile networks separated by a fixed transit network, by way of example only, with reference to the drawings wherein:

Figure 1 is a schematic diagram of a prior art system used to allow communication between one mobile/fixed station in a mobile/fixed communication network and another mobile/fixed station in another mobile/fixed telecommunication network separated by a fixed transit network.

Figure 2 is a schematic diagram of a system used to allow communication between one mobile station and another mobile station in accordance with the present invention, and

Figure 3 illustrates one form of the data format used in accordance with the present invention.

Shown in Figure 2 is a system 2 whereby user data, such as voice data, is transmitted and received in a first mobile network 4 and a second mobile network 6 and traverses a fixed telecommunication transit network 8, such as PSTN or ISDN without the use or need for transcoders. Thus data packets representing digitally compressed voice may be transmitted and received between the two mobile networks 4 and 6 in the compressed format over the fixed transit network 8 even though the bit rate used in either of the two mobile networks 4, 6 is different to the bit rate used in the fixed transit network 8. The bit rate used over the first mobile network 4, represented as a first mobile transmission rate, may be

8 or 16 kbit/s, for example, depending on whether full-rate or half-rate is used. Similarly, a second mobile transmission rate may be used over the second mobile network 6 at a rate of 8 or 16 kbit/s. The first mobile transmission rate and second mobile transmission rate may be the same. A fixed transit network transmission rate may be used over the network 8 and is typically 64 kbit/s in a PCM coded format which is time division multiplexed.

The system 2 includes a rate adapter unit 10 interfacing the fixed transit network 8 to the first mobile network 4 and a rate adapter unit 12 interfacing the fixed transit network 8 with the second mobile network 6. The PLMN 4, has a mobile switching centre (MSC) 14 that is linked to various base transceiver stations 16, 18 (BTS) which in turn have mobile stations (MS) 20, 21, 22 and 23 that are in communication with the BTSs 16, 18 over respective radio links 24-27. A Gateway Mobile Switching Centre (GMSC) 28 interfaces the fixed transit network 8 and the PLMN 4 and handles subscriber data and signalling between the two networks. Similarly PLMN network 6 has a respective MSC 30 which is linked to BTSs 32, 34 which in turn may be in communication with any one of mobile stations 35, 36, 37 or 38 over respective radio links 40-43. A further GMSC 44 interfaces the fixed transit network 8 with the PLMN 6 for handling the user data and signalling between the two networks 6, 8. The GMSC 28 and rate adapter unit 10 may be co-located at the interface between PLMN 4 and the fixed transit network 8. Similarly, the GMSC 44 and rate adapter unit 12 may be co-located at the interface between PLMN 6 and the fixed transit network 8.

A mobile station 20 in PLMN 4 communicates with a mobile station 35 in PLMN 6 whereby user data such as the user's voice is coded and compressed within the mobile station 20 and transmitted over radio link 24 to BTS 16. The user-data is forwarded through the MSC 14 and through to the GMSC 28 in a compressed format contained in a first mobile frame structure. The GMSC 28 will determine whether or not the call is destined for another mobile station in a distant mobile network such as PLMN 6 and if so will generate a fixed transit network frame structure and insert the user data and signal to the rate adapter unit 10 to initiate and generate additional stuff bits to be inserted into the fixed transit network frame structure to be transmitted across the transit network 8

synchronously at the 64 kbit/s fixed transit network transmission rate. The particular coding used, for example where the stuff bits are inserted into each frame of the user data, is implicitly known or indicated by signalling, for example from GMSC 28, as is known in the art. This process is generally called bit stuffing or flag stuffing where extra bits are inserted into the fixed transit network frame structure so that the user data can be transmitted in a compressed digital format. The user data from mobile station 20 is transmitted over the fixed transit network 8 through a link 50 to the rate adapter unit 12, which on receiving a signal from GMSC 44, extracts the stuffed bits or stuff flags from the fixed transit network frame structure. Again, it is implicit that the rate adapter unit 12 is able to determine which stuff bits are to be removed in accordance with known coding techniques. In this way the rate is adapted from a 64 kbit/s transmission down to the required second mobile transmission rate over PLMN 6 which is typically 8 or 16 kbit/s. The user data is then forwarded in a second mobile frame structure at the second mobile transmission rate through the GMSC 44, MSC 30 to the respective BTS 32 to be received by MS 35 over radio link 40. The GMSC 44 may be co-located with rate adapter unit 12 at the interface between fixed transit network 8 and PLMN 6.

In this manner the user data from MS 20 or from MS 35 is transceived in a compressed format and remains in a compressed format as it is transmitted over the fixed PSTN or ISDN 8. The reverse process occurs when user data is transmitted from MS 35 to MS 20 whereby rate adapter unit 12 inserts stuff bits into the fixed transit network frame structure on receipt of a signal from GMSC 44 to synchronise the data format to the PCM 64 kbit/s fixed transit network transmission rate over network 8 over link 50. When the user data arrives at the rate adapter unit 10, interfacing to the PLMN 4, on receipt of a signal from GMSC 28, the adapter unit 10 extracts the stuffed bits from the fixed transit network frame structure and the original compressed user data is forwarded in the first mobile frame structure over PLMN 4 to mobile station 20.

With reference to Figure 3 there is shown an example of a first mobile frame structure 60 representing the compressed digital voice transmitted over the first PLMN 4 at a first mobile transmission rate of 8 or 16 kbit/s. This is then rate

adapted by the respective rate adapter unit 10 at the interface to the fixed transit network 8 whereby the rate adapter 10 adds extra stuff bits or stuff flags to the first mobile frame structure to form a new fixed transit network frame structure 62 carried over the network 8 which is synchronous with the 64 kbit/s fixed transit network transmission rate over the fixed transit network 8. Thereafter the stuff bits are extracted by the other respective rate adapter unit 12 at the interface to the second PLMN 6 so that only the compressed digital user data contained in a second mobile frame structure 64 is transmitted over the PLMN 6 to the respective mobile station at a second mobile transmission rate, typically 8 or 16 kbit/s.

The present invention is particularly suited but is not limited to use in second generation PLMNs such as Global System for Mobiles (GSM), Digital American Mobile Phone System (D-AMPS) and third generation PLMNs such as Universal Mobile Telecommunications Service (UMTS) and CDMA-2000.

The present invention provides a method and system for allowing communications between mobile stations through a public switched network without the need for transcoders and therefore substantially improves the voice quality of such communication.

Preferred embodiments of the present invention include means for effecting the rate adaptation process which are contemplated to be any one or a combination of hardware, software and / or firmware. One example implementation of a rate adaptation device / step is using DSP technology. Means for effecting the rate adaptation process, such as mentioned above, would comply with known ITU Recommendations for data and voice communication such as but not limited to V.110, V.120, X.30, and X.31.

It is to be appreciated that the embodiment described above relates, by example only, to the use of the present invention to allow communication between mobile station(s) and another mobile station(s) over a fixed transit network. The invention may also be used to allow communication between fixed station(s) and another fixed station(s) over a fixed transit network. Equally, the present invention enables communication between mobile station(s) and fixed station(s), and visa versa.

At a practical level, and for the purposes of illustration, the present invention allows for improved speech quality when interconnecting two mobile or fixed stations via a PSTN/ISDN transit network, when compared to prior art solutions requiring voice transcoders.

It will be appreciated by the person skilled in the art that various modifications maybe made to the above described embodiment without departing from the scope of the present invention. Any such modifications are intended to be incorporated into the scope of the present application.

CLAIMS

1. A method of enabling information to pass between a first network based on a first technology and a second network based on a second technology, the method including the step of:

imposing rate adaptation upon the information prior to passing from the first to the second network.

2. A method as claimed in claim 1, where the information is further passed from the second network to a third network based on the first technology, and in which the step of imposing rate adaptation is applied to the information passing from the second to the third network.

3. A method as claimed in claim 1 or 2, where the information is a compressed voice stream.

4. A method as claimed in claim 1, 2 or 3, wherein the rate adaptation is performed by a bit stuffing technique.

5. A communication system, including:

a first network based on a first technology,

a second network based on a second technology, and

interface means applying rate adaptation to information transferred from the first network to the second network.

6. A system as claimed in claim 5, further including

a third network based on the first technology, and

interface means applying rate adaptation to the information transferred from the second to the third network.

7. A system as claimed in claim 5 or 6, wherein the second network includes a plurality of telecommunication networks.

8. A system as claimed in claim 5, 6 or 7, where the information is a compressed voice stream.

9. A system as claimed in any one of claims 5 to 8, wherein the rate adaptation is performed by a bit stuffing technique.

10. A method of communicating between a mobile/fixed station in a first mobile/fixed telecommunications network and a mobile/fixed station in a second mobile/fixed telecommunications network whereby communication takes place over a fixed telecommunications transit network separating said first mobile/fixed and second mobile/fixed telecommunication networks, said method including the steps of:

transmitting user data in a compressed digital format in said first mobile/fixed telecommunications network at a first mobile/fixed transmission rate;

transmitting user data in said compressed digital format in said second mobile/fixed telecommunications network at a second mobile/fixed transmission rate;

transmitting said user data in said compressed digital format in said fixed telecommunications transit network at a fixed transit network transmission rate, wherein said fixed transit network transmission rate is greater than said first mobile/fixed and second mobile/fixed transmission rates; and

adapting the transmission rate of said user data at respective interfaces between said fixed telecommunications transit network and said first mobile/fixed and second mobile/fixed telecommunications networks by inserting additional stuff data into respective frame structures containing said user data or extracting said additional stuff data from said respective frame structures.

11. A method as claimed in claim 10, wherein the user data is contained in a first mobile/fixed frame structure when transmitted across said first mobile/fixed network, in a second mobile/fixed frame structure when transmitted across said second mobile/fixed network and in a fixed transit network frame structure when transmitted across said fixed transit network.

12. A method as claimed in claim 10 or 11, wherein the step of adapting further includes inserting stuff bits into said fixed transit network frame structure when said user data is transmitted across an interface from either said first mobile/fixed or said second mobile/fixed network into said fixed transit network.

13. A method as claimed in claim 10, 11 or 12, wherein the step of adapting further includes removing stuff bits from said fixed transit network frame structure when said user data is transmitted across an interface from said fixed transit network to either of said first mobile/fixed or second mobile/fixed networks.

14. A method as claimed in claim 10, wherein the step of adapting further includes flag stuffing or flag extracting such that bits are either inserted into or removed from said respective frame structures containing said user data.

15. A system of communicating between a mobile/fixed station in a first mobile/fixed telecommunications network and a mobile/fixed station in a second mobile/fixed telecommunications network, said system including:

said first mobile/fixed telecommunications network in which user data is transmitted in a compressed digital format at a first mobile/fixed transmission rate;

said second mobile/fixed telecommunications network in which said user data is transmitted in said compressed digital format at a second mobile/fixed transmission rate;

a fixed telecommunications transit network separating said first mobile/fixed and second mobile/fixed telecommunications networks, whereby said user data is transmitted across said fixed transit network in said compressed digital format at a fixed transit network transmission rate,

said fixed transit network transmission rate being greater than said first mobile/fixed and second mobile/fixed transmission rates; and

rate adapter means located at respective interfaces between said fixed telecommunications transit network and said first mobile/fixed and second mobile/fixed networks for adapting the transmission rate of said user data to the transmission rate of the network subsequently carrying said user data as said

user data traverses each said interface wherein additional stuff data is either inserted into or extracted from respective frame structures containing said user data.

16. A system as claimed in claim 15, wherein the user data is contained in a first mobile/fixed frame structure when transmitted across said first mobile/fixed network, in a second mobile/fixed frame structure when transmitted across said second mobile/fixed network and in a fixed transit network frame structure when transmitted across said fixed transit network.

17. A system as claimed in claim 15 or 16, wherein the rate adapter means includes a first rate adapter unit interfacing said first mobile/fixed network with said fixed transit network and a second rate adapter unit interfacing said second mobile/fixed network with said fixed transit network.

18. A system as claimed in claim 15, 16 or 17, wherein the first rate adapter unit inserts stuff bits into said fixed transit network frame structure when said user data is transmitted from said first mobile/fixed network to said fixed transit network so as to adapt the user data to the fixed transit network transmission rate.

19. A system as claimed in any one of claims 15 to 18, wherein the first rate adapter unit extracts stuff bits from said fixed transit network frame structure when said user data is transmitted from said fixed transit network to said first mobile/fixed network so as to adapt the user data to the first mobile/fixed transmission rate.

20. A system as claimed in any one of claims 15 to 19, wherein the second rate adapter unit inserts stuff bits into said fixed transit network frame structure when said user data is transmitted from said second mobile/fixed network to said fixed transit network so as to adapt the user data to the fixed transit network transmission rate.

21. A system as claimed in any one of claims 15 to 20, wherein the second rate adapter unit extracts stuff bits from said fixed transit network frame structure when said user data is transmitted from said fixed transit network to said second mobile/fixed network so as to adapt the user data to the second mobile/fixed transmission rate.

22. A system as claimed in claim 21, wherein the first mobile/fixed transmission rate and the second mobile/fixed transmission rate are the same.

23. A system as claimed in claim 22, wherein the first mobile/fixed and second mobile/fixed transmission rates are full-rate or half-rate.

24. A system as claimed in claim 21, wherein the first mobile/fixed transmission rate and the second mobile/fixed transmission rate are different.

25. A system as claimed in claim 24, wherein the first mobile/fixed transmission rate is full-rate or half-rate and the second mobile/fixed transmission rate is half-rate or full-rate respectively.

26. A system as claimed in any one of claims 15 to 25, wherein stuff flags are used such that bits are inserted into or extracted from respective frame structures containing said user data.

27. A system, device and / or apparatus as herein disclosed.

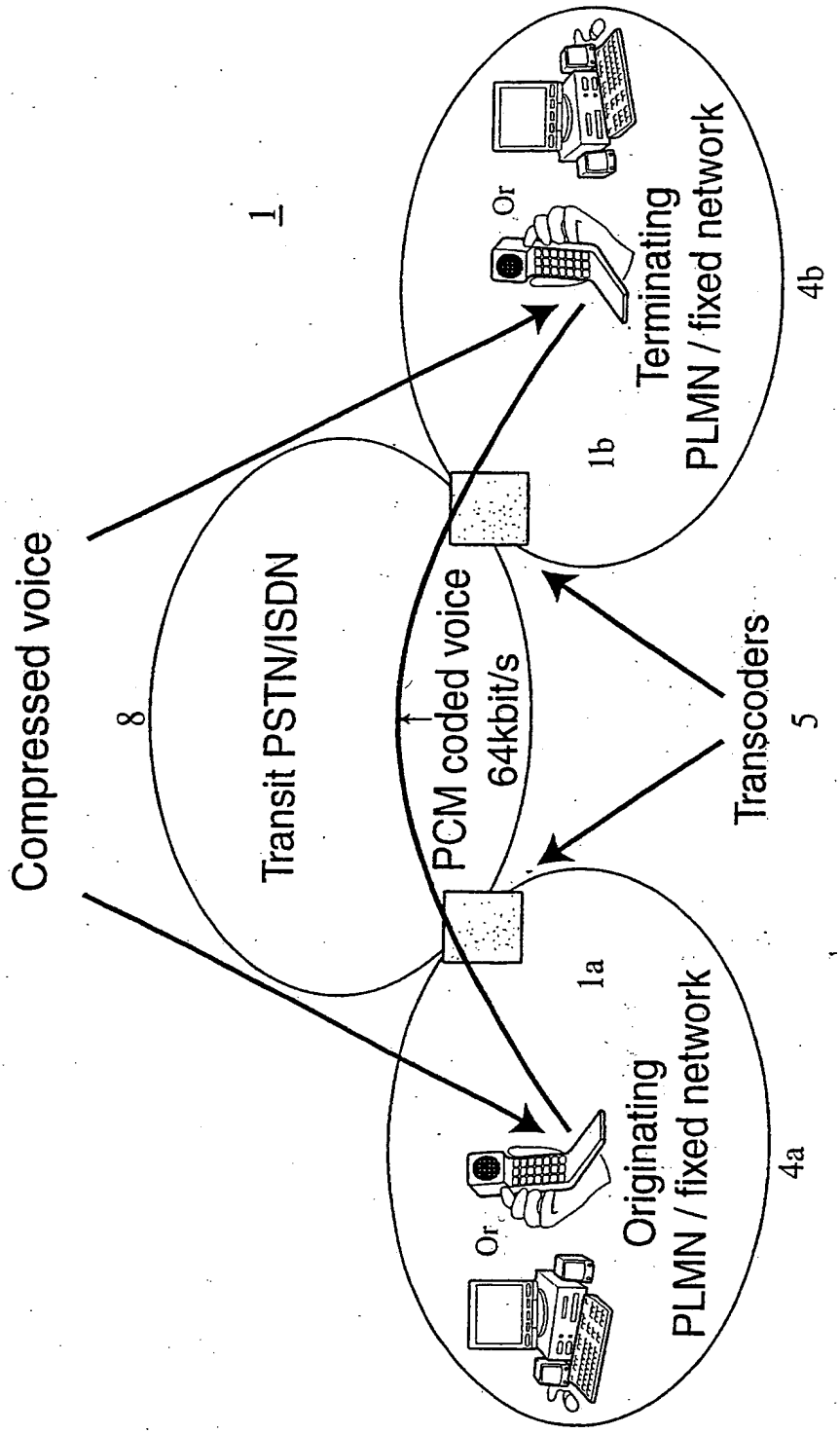
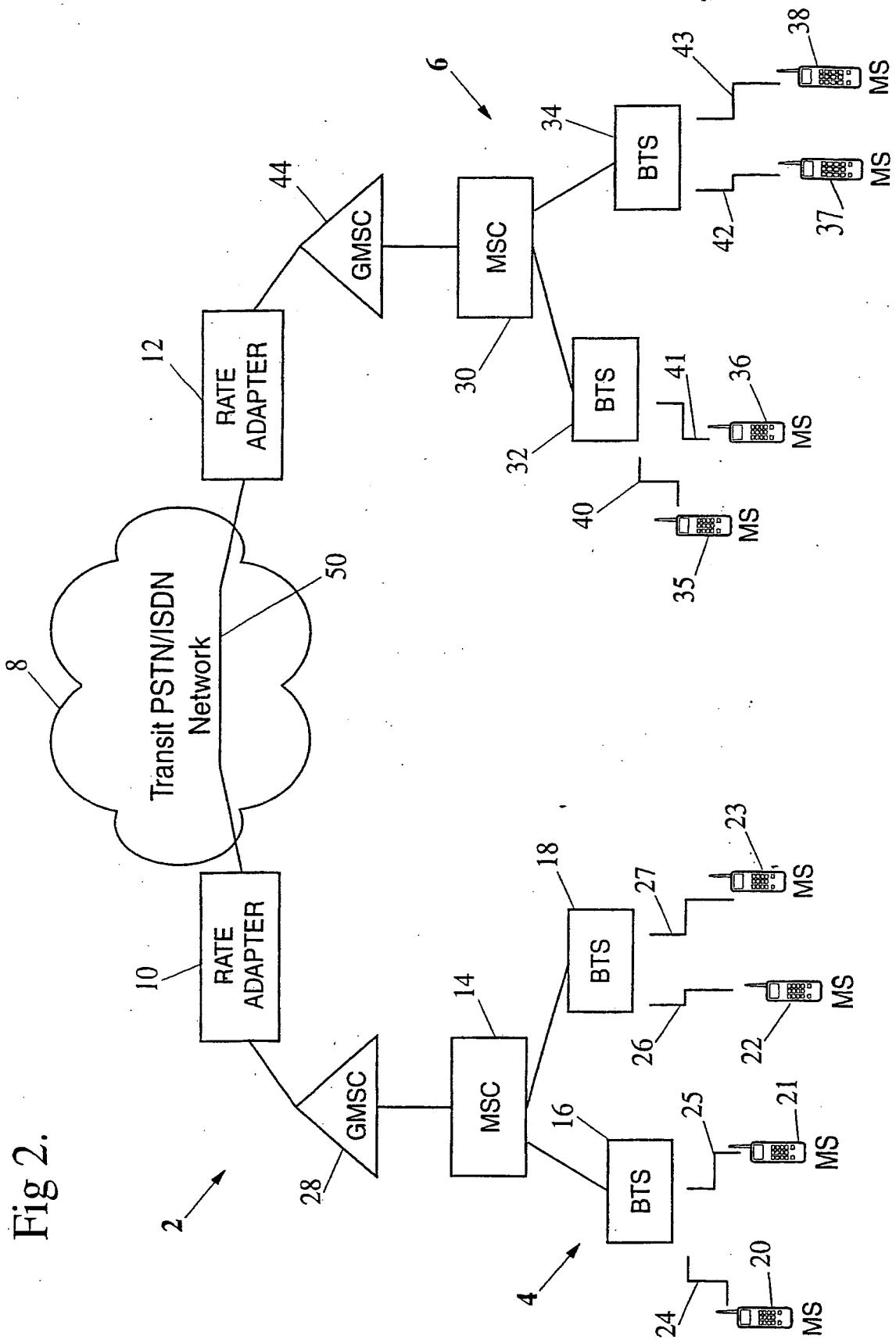


Fig 1.
(Prior Art)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8
50
RATE ADAPTER
12
RATE ADAPTER
10
GMSC
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GMSC
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MSC
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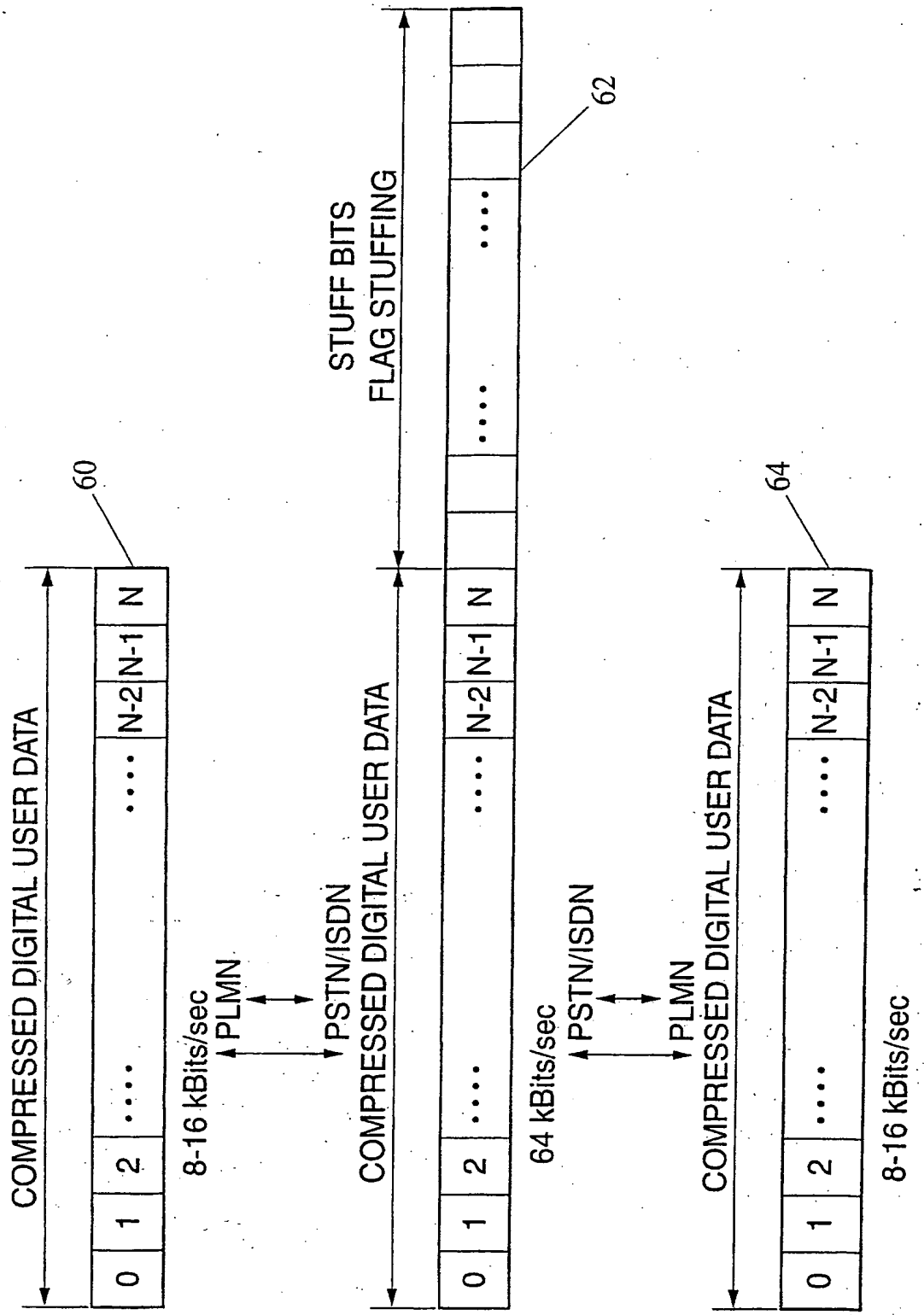
Fig 2.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COMPRESSED DIGITAL USER DATA
64 kBits/sec
PSTN/ISDN
PLMN
64
COMPRESSED DIGITAL USER DATA
8-16 kBits/sec

Fig 3.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU00/00809

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. [7]: H04L 12/66

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04L 12/66

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPAT, USPTO, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5850391 A (Essigmann) 15 December 1998 Whole Document	1-27
X	US 5710756 A (Pasternak et al) 20 January 1998 Whole Document	1-27
X	US 5623312 A (Yan et al) 22 April 1997 Whole Document	1-27

[X] Further documents are listed in the continuation of Box C - [X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 August 2000	-6 SEP 2000
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized officer R.H. STOPFORD Telephone No : (02) 6283 2177

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU00/00809

C (Continuation). **DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5461618 A (Chen et al) 24 October 1995 Whole Document	1-27
X	US 5448560 A (Chen et al) 5 September 1995 Whole Document	1-27
X	US 5335225 A (Brax) 2 August 1994 Whole Document	1-27

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/AU00/00809

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	5850391	AU	47307/97	BR	9712355	EP	932990
		WO	9817076	ZA	9708834		
US	5710756	AU	51691/96	EP	809896	WO	9625806
		AU	72462/96	EP	795212	WO	9713292
US	5623312	EP	719055	JP	8237663		
US	5461618	DE	4228316	GB	2268375		
US	5448560	DE	4326664	GB	2273855		
US	5335225	AU	88787/91	EP	511345	FI	905698
		FI	915698	NO	922848	WO	9209157

END OF ANNEX